

REMARKS

In view of the following amendments and remarks responsive to the Office Action of December 4, 2003, Applicant respectfully requests favorable reconsideration of this application.

In Section 4 of the Office Action, the Office asserted that the application does not contain an abstract. Applicant's records show that the application was filed with an abstract. Applicant provides another copy of the Abstract herewith.

In Section 5 of the Office Action, the Office objected to claim 20, indicating that the words "said until" should be "until said." Applicant has amended claim 20 accordingly.

In Sections 6 and 7 of the Office Action, the Office rejected claims 10-12 and 22-24 under 35 U.S.C. §112, second paragraph, as being indefinite. In short, the Office asserted that the variables in the equations must be defined directly within the claims. Applicant has herein amended claims 10 and 22 accordingly to add such definitions. However, to avoid confusion from underlining equations, rather than amending claims 10 and 22, Applicant has cancelled them and resubmitted them anew as new claims 25 and 26, respectively. Note that, in the new claims, Applicant also has corrected some clerical errors with those claims. Specifically, the dependency of the claims have been changed. Furthermore, the lower case "g" in the expression

$\hat{F}_{G-1} = \arg \max_{F_{G-1}} \text{Tr}\{JP_{G-1G-1}(F_{G-1})\}$ has been corrected to an upper case "G". This last error

was carried over from the specification (page 24, line 5, discussed below), which also has been corrected herein. The error would have been an obvious typographical error to a person of ordinary skill in the art and its correction does not constitute new matter.

Applicant has cancelled claims 12 and 24 as superfluous. No new matter has been added, as all of the definition are found in the specification as originally filed. For instance, the definitions of f_k and \bar{f}_k are found at the top of page 23, the definition of \hat{F}_{G-1} is found in the middle of page 23, the definition of G is found at the bottom of page 10, the definition of J is found at the top of page 19, and the definition of $P_{G-1|G-1}F_{G-1}$ is found in the middle of page 24.

In Sections 8 and 9 of the Office Action, the Office rejected claims 1, 2, 13, and 14 under 35 U.S.C. §103(a) as being unpatentable over the admitted prior art as shown in Figure 1 in view of Nowak. Specifically, the Office asserted that the admitted prior art according to Figure 1 discloses an apparatus for performing beamforming on a plurality of signals in a reception channel received from a receiving antenna array, the signals including simultaneous data signals from a plurality of transmitters, a frequency down converting circuit for converting the beam signal baseband, and a multi-task/multi-user explanation circuit for generating path estimates and path estimate errors for each of the multiple simultaneous transmitters from the baseband beam signals. The Office asserted that the admitted prior art also discloses a beamforming antenna array. The Office conceded that the admitted prior art does not disclose (1) an Nx1 switch beam beamforming circuit for weighting and combining the outputs of the N antenna receiving

elements and generating a single beam therefrom based on a beam scheduling sequence or (2) a beam schedule generating circuit for generating the beam scheduling sequence for switches between ones of the plurality of beams for generation by the beamforming circuit.

However, the Office asserted that Nowak teaches an Nx1 switched beam beamforming circuit for weighting and combining outputs of N antenna receiving elements and generating a single beam therefrom based on a beam scheduling sequence as column 3, lines 61-62 and Figure 2, reference numeral 28, and a beam scheduled generating circuit for generating the beam scheduling sequence for switching between ones of a plurality of beams for generation by the beamforming circuit (column 1, lines 55-60; column 3, lines 59-61; and Figure 2, reference numeral 26). The Office asserts that it would have been obvious to utilize the Nx1 switched beam beamforming circuit and beam scheduling circuit of Nowak in the admitted prior art because, by using the Nx1 beamforming switch and beamforming sequence circuit as taught by Nowak, the admitted prior art could be simplified to contain fewer circuits.

Applicant respectfully traverses.

Nowak is very different system than the present invention. For instance, Nowak is a fixed beam system (see, for instance, the Title "Extremely High Frequency Fixed-Access Wireless Communication System) whereas the present invention pertains to a switched beam system defined on page 3, line 21, et seq. Instead of using multiple omni-directional antennas, it uses multiple fixed-directional antennas. Other significant

distinctions include the fact that the present invention concerns the combining of beams to obtain the best reception for a plurality of beams from a plurality of moving users, whereas Nowak's disclosure concerns optimizing single user reception in a stationary (i.e., fixed-access) environment. In fact, as will become clear from the discussion below, Nowak is so different from the present invention and the admitted prior art as to render specious any assertion that it is obvious to combine the admitted prior art with any portion of Nowak. That is, the two systems have fundamentally different operating paradigms such that one reference would not lead the person of skill in the art to any conclusions about the other, except for the most generalized concepts relating to wireless communications.

However, the issue of whether or not it is appropriate to combine the two references is moot because Nowak actually does not teach that for which it has been cited, i.e., the claimed beamforming circuit.

Specifically, the portion of Nowak cited by the Office concerns the well-known aspect of cellular communications wherein a plurality of directional receiving facets, typically three facets (although Nowak shows eight facets in Figure 3) with each facet comprising two antenna elements, cover a cell and the system determines which facet is receiving the highest quality signal and then selects that facet to the exclusion of the other facets. More particularly, element 28 in figure 2 of Nowak is a simple Nx1 RF switch that selects the signal from one of the antenna elements 20, 22 or 24. It does not weight and combine the outputs of the N antenna receiving element. Rather, it

merely selects one of the N antenna receiving elements. See, for instance, column 3, lines 61 – column 4, line 1, which states:

The controller 26 controls through the RF switch matrix 28 the facet from which the signal is to be received at a given time. In the illustrated embodiment, the RF switch matrix 28 consists of one N:1 RF switch 31 where N = 3 is the number of antenna facets. The signal selected is routed through a low noise RF block downconverter 30 and a filtering and demodulating stage 32.

As noted in the present specification, for instance, on page 6, lines 18-20 and page 9, lines 19-21, a key advantage of the present invention is the reduction down to forming one beam of RF data for processing at any given instance. While Nowak, in fact, has only one RF output from the switch 28, that is not because he is beamforming multiple beams, but merely because all that Nowak is doing is selecting a single facet having the best reception of a single, stationary user. Nowak simply does not address the problem addressed by the present invention.

Claim 1 recites “an Nx1 switch beam beamforming circuit for weighting and combining outputs of N antenna receiving elements and generating a single beam therefrom based on a beam scheduling sequence”. Nowak’s simple switch does not meet this limitation. It does not weigh and combine the signals from the antenna elements. Rather, it merely is selecting one of the antenna elements.

Independent claim 13 contains substantively a similar limitation as claim 1. Accordingly, both independent claims 1 and 13 patently distinguish over the asserted prior art. Claims 2 and 14 depend from claims 1 and 13, respectively. Accordingly, they distinguish over the prior art for at least the same reasons.

The Office rejected the remaining claims, claims 3-9 and 15-21, under 35 U.S.C. §103 as being obvious over the admitted prior art in view of Nowak and further in view of Chang. Particularly, Chang has been cited as allegedly teaching some of the elements of the dependent claims. A detailed discussion of Chang is not necessary as Chang clearly does not teach the above-discussed elements of claims 1 and 13 that are lacking from Nowak and the admitted prior art. All of claims 3-9 and 15-21 depend from claim 1 or claim 13 and, therefore, distinguish over the prior art for at least all of the reasons set forth above in connection with claims 1 and 13.

As a final matter, in reviewing this application in preparation for filing this response, applicant has detected several typographical errors in the equations and corrected them herein. For instance, on page 24, lines 8, the open loop control function was written as $f(k, A(\phi), A_k, Q, R)$ (with the f lacking a hat, whereas, just above in equation 42, the open loop control function had been defined as \bar{f} and the closed loop control function had been defined a plain, old f . Also, on page 23, line 11, the sequence $(f_0, f_1, \dots, f_{G-1})$, obviously should be $(f_0, f_1, \dots, f_{G-1})$. Furthermore, in the equation on page 24, line 5, , the lower case "g" in the expression

$\hat{F}_{G-1} = \arg \max_{F_{G-1}} \text{Tr}\{JP_{G-1G-1}(F_{G-1})\}$ has been corrected to an upper case "G". Again, the

change is not new matter, as it merely corrects an obvious typographical error. The term $g-1$, in which has previously been defined in the specification as the directivity gain of an antenna element (page 12, line 14), would make no sense, whereas $G-1$, in which

has previously been defined as the integer ratio T_b/T_c , is the obviously intended symbol in the context of the immediately preceding equations (e.g., see all of the equations between page 23, line 10 and page 24, line 4, all of which indexed by G-1). Finally, on page 24, line 12, Equation 48 was missing an A. Since Equation 48 is merely a copy of the Riccati equation, which is well known in the prior art, this change also does not constitute new matter.

Other typographical errors have been corrected and should be self-explanatory from the surrounding specification.

In view of the foregoing amendments and remarks, this application is now in condition for allowance. Applicant respectfully requests the Examiner to issue a Notice of Allowance at the earliest possible date. The Examiner is invited to contact Applicant's undersigned counsel by telephone call in order to further the prosecution of this case in any way.

Respectfully submitted,



Theodore Naccarella
Registration No. 33,023
Synnestvedt & Lechner LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107
(215) 923-4466
Attorneys for Applicant